

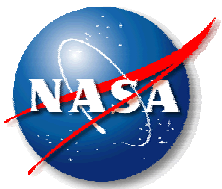


# SEU Theme Update

Including Beyond Einstein, Einstein Probes,  
and Vision Missions

Paul Hertz  
SEU Theme Scientist  
Astronomy & Physics Division

Structure and Evolution of the Universe Subcommittee  
February 24, 2004



# President's Vision: Goals and Objectives

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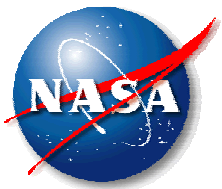
- Implement a sustained and affordable human and robotic program to explore the solar system and beyond.
- Extend human presence across the solar system, starting with a human return to the Moon by the year 2020, in preparation for human exploration of Mars and other destinations.
- Develop the innovative technologies, knowledge, and infrastructures both to explore and to support decisions about the destinations for human exploration.
- Promote international and commercial participation in exploration to further U.S. scientific, security, and economic interests.



# President's Vision: Implementation

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- Retire the Space Shuttle as soon as assembly of the International Space Station is completed, planned for the end of this decade.
- Focus U.S. research and use of the International Space Station on supporting space exploration goals, with emphasis on understanding how the space environment affects astronaut health and capabilities and developing countermeasures.
- Undertake lunar exploration activities to enable sustained human and robotic exploration of Mars and more distant destinations in the solar system.
- Starting no later than 2008, initiate a series of robotic missions to the Moon to prepare for and support future human exploration activities.
- Conduct the first extended human expedition to the lunar surface as early as 2015, but no later than the year 2020.



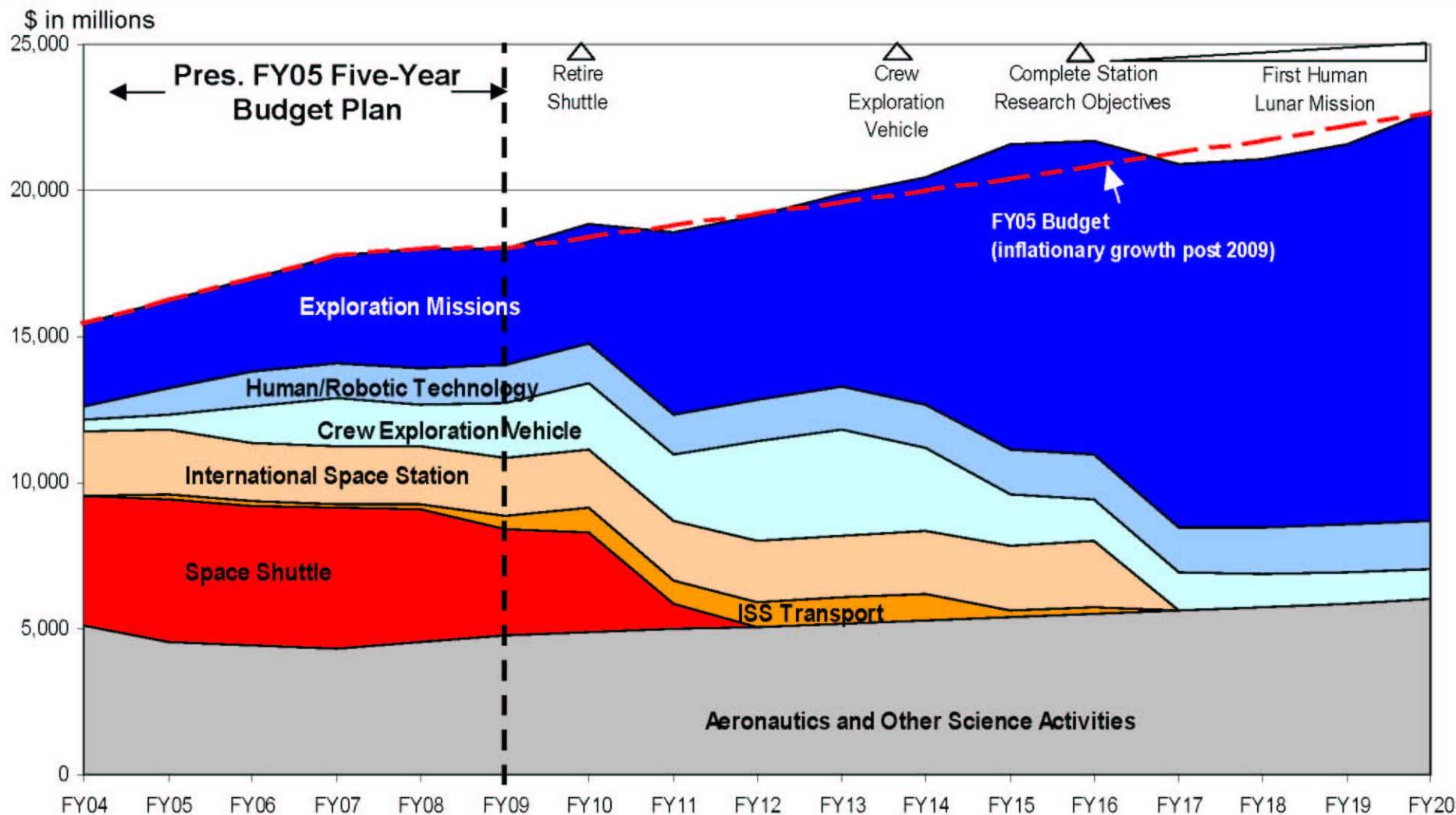
# President's Vision: Implementation

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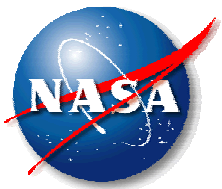
- Develop a new crew exploration vehicle to provide crew transportation for missions beyond low Earth orbit.
- Conduct robotic exploration of Mars to search for evidence of life, to understand the history of the solar system, and to prepare for future human exploration.
- Conduct robotic exploration across the solar system for scientific purposes and to support human exploration. In particular, explore Jupiter's moons, asteroids and other bodies to search for evidence of life, to understand the history of the solar system, and to search for resources.
- Conduct advanced telescope searches for Earth-like planets and habitable environments around other stars.
- The Administrator will plan and implement an integrated, long-term program executed on the basis of available resources.



# Strategy Based on Long-Term Affordability



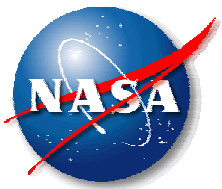
NOTE: Exploration missions – Robotic and eventual human missions to Moon, Mars, and beyond  
Human/Robotic Technology – Technologies to enable development of exploration space systems  
Crew Exploration Vehicle – Transportation vehicle for human explorers  
ISS Transport – US and foreign launch systems to support Space Station needs especially after Shuttle retirement



# President's FY05 Budget Released

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- Supports the President's vision for space exploration
  - Implementation requires significant refocusing of NASA efforts
  - NASA activities have been reprioritized, and budgets for some activities have been reduced
- Macro changes for Space Science
  - Increase by 4% next year, and by 40% over four years
  - New theme added: Lunar Exploration
  - Four themes included in Exploration: Astronomical Search for Origins, Solar System Exploration, Mars Exploration, Lunar Exploration
  - Sun-Earth Connections and Structure and Evolution of the Universe have been reduced as priorities have been re-focused
- Ed Weiler and Anne Kinney will provide details

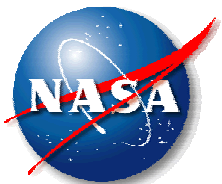


# President's FY05 Budget Released

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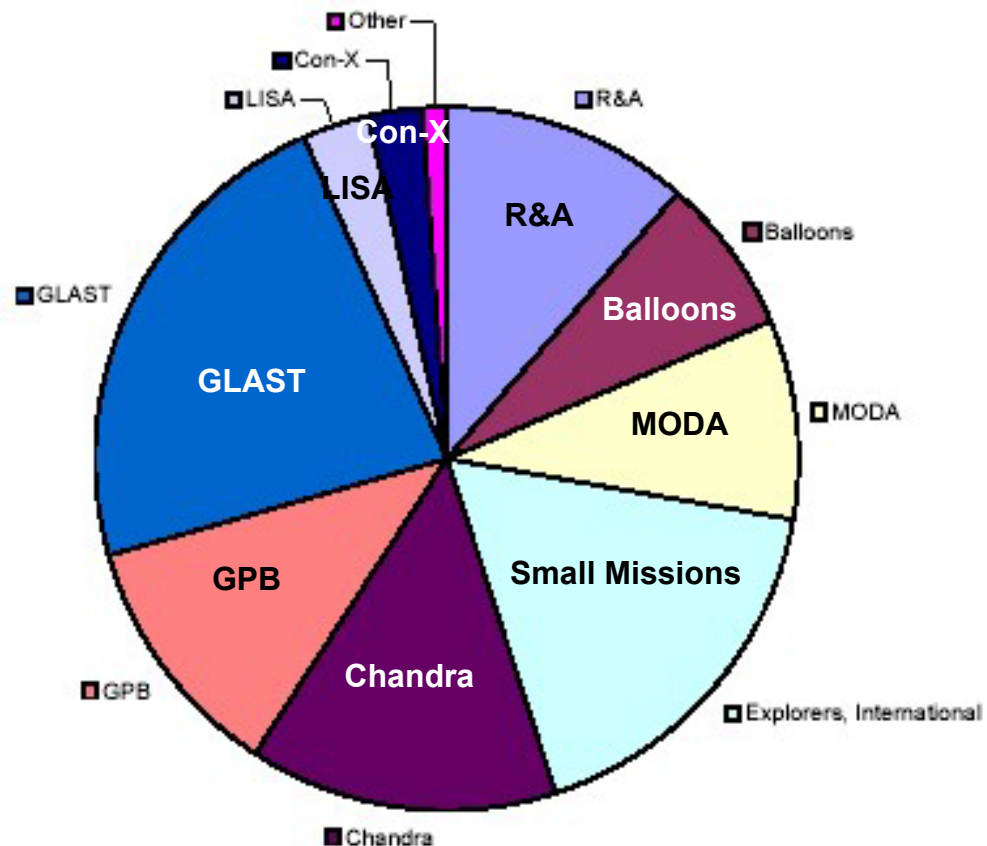
- Major Changes: Structure and Evolution of the Universe
  - LISA delayed “one year” (to 2013)
  - CON-X delayed “two years” (to NET 2016)
  - Einstein Probes deferred beyond the current budget horizon (no funding for at least five years)
  - Some additional funding provided to GP-B and GLAST (and Swift)
- Major Changes: Astronomical Search for Origins
  - HST SM-4 cancelled due to safety considerations
    - Examine ways to extend operational life without additional servicing
    - De-orbit via an autonomous rendezvous mission
  - JWST funding profile shifted forward for schedule recovery/assurance



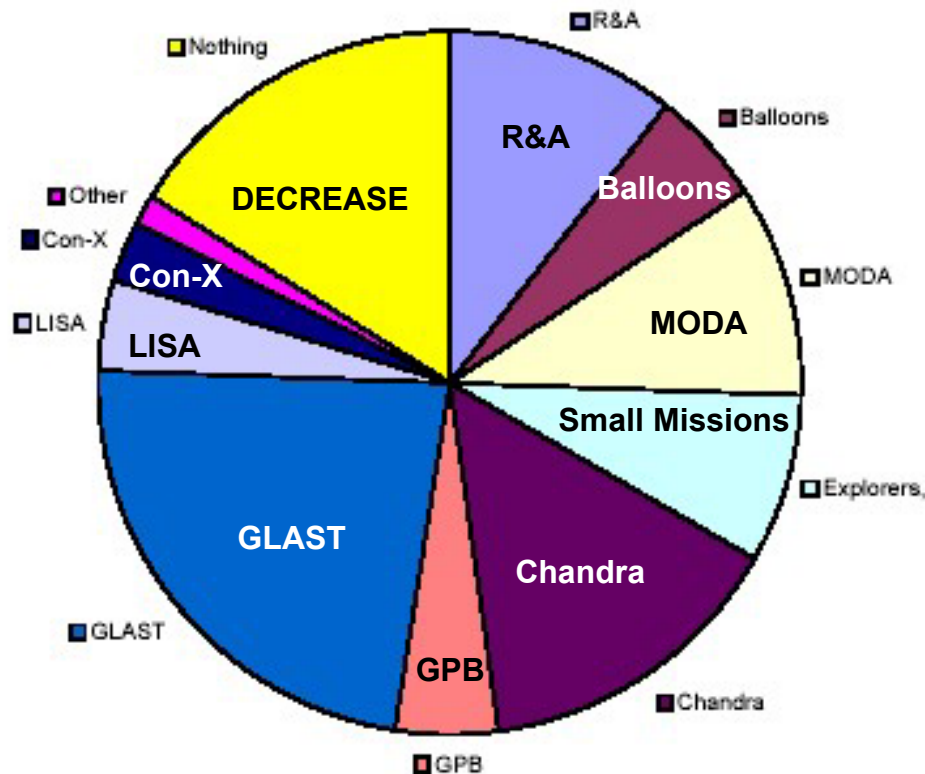


# SEU Budget Distribution

FY04 Budget (\$450M)



FY05 Budget Request (\$375M)

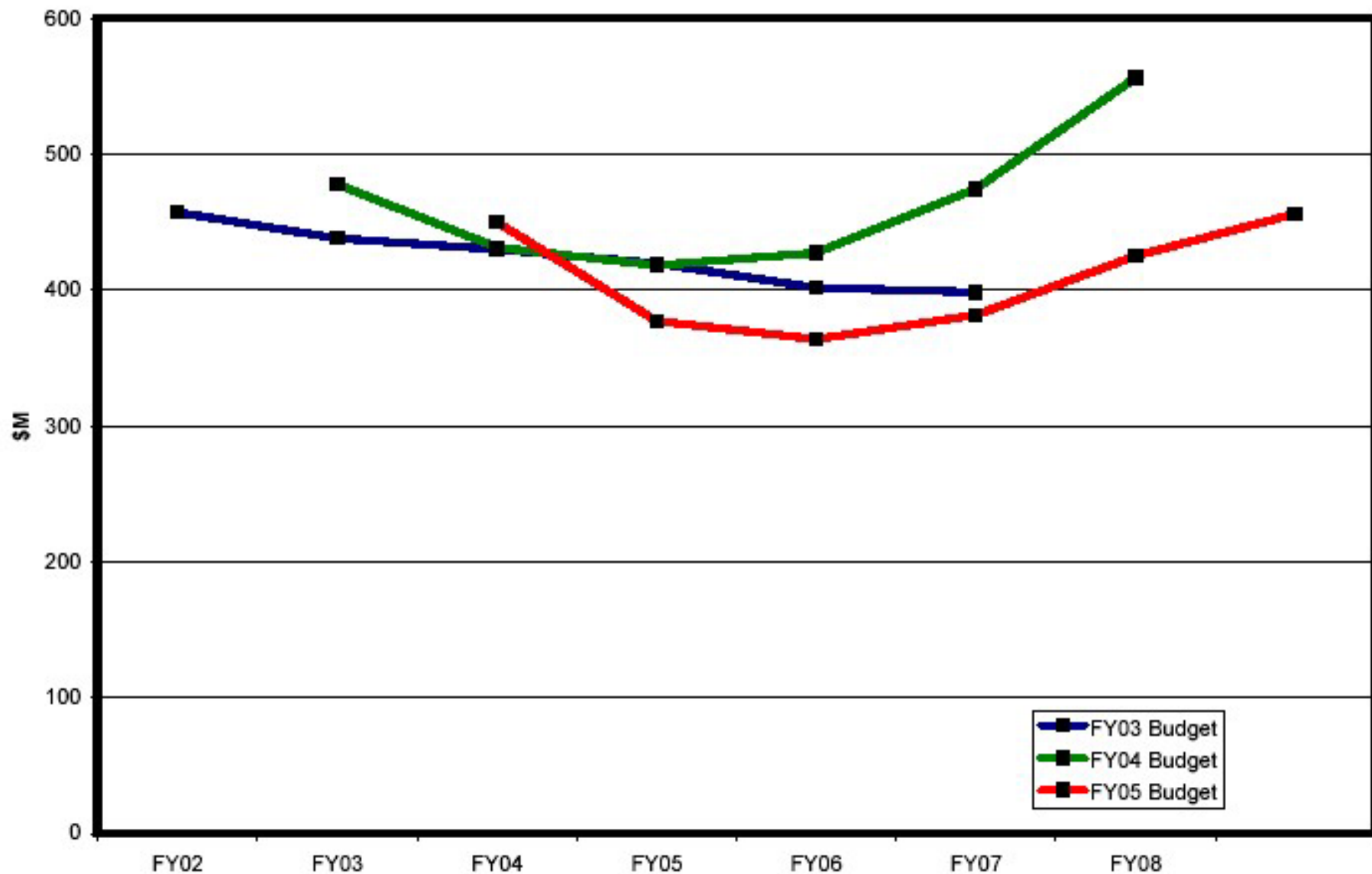


Small Missions = Swift, Astro-E2, Herschel, Planck, EUSO (development only)





# SEU Budget Projection





# SEU Mission Status

Launch		Dec	Jan	Feb	STATUS
GP-B	Apr '04	RED	YEL	YEL	ECU was removed, reworked, tested, and reinstalled in space vehicle. System-level regression testing has started.
SWIFT	Jul '04	RED	RED	YEL	Image processor problem taking longer to solve than planned.
Astro-E	Feb '05	RED	YEL	YEL	XRS delivery to Japan scheduled for March 12.
GLAST	Feb '07	GRN	YEL	YEL	New LAT tracker structural interface design approved. LAT FSW development monitoring in place. LAT ACD PMT failure potential causes and fixes identified and under analysis.
Hersch	2007	RED	YEL	YEL	Project estimates need for \$3.5M increase in FY05. Production of instrument components going well.
Planck	2007	YEL	YEL	YEL	Possible reduced cryocooler lifetime is still an issue. Production of instrument components is going well.
EUSO	2008	GRN	RED	RED	Waiting for ESA decision. Availability of Shuttle for launch is now uncertain.
LISA	2011	GRN	YEL	YEL	Drafting a management framework white paper with ESA, to be completed by the end of March.
Con-X	2013	GRN	GRN	GRN	Replan underway due to reduced funding profile FY04-FY09. Project Manager has been reassigned. Current Deputy will become Project Manager.
Balloon	Ongoing	GRN	GRN	GRN	Schedule for new Antarctica facilities shows setup completed by October 2005.

**GRN**

Proceeding on Plan, only normal, minor problems

**YEL**

Significant Problems or Concerns but feasible plan to resolve

**RED**

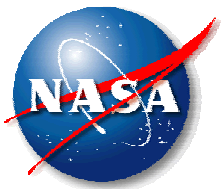
Major Problems; Solution path unclear



# Beyond Einstein Program

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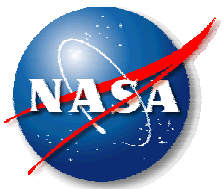
- Reduction in FY05-09 budget requires serious changes in plans
  - LISA: slow down planned work to match budget; replan mission development; identify resource mismatch with ESA
  - Con-X: slow down planned work to match budget; identify highest priority technology development for period of very low funding; continue discussions with potential international partners to share costs
  - Einstein Probes: carry out mission concept studies to be prepared for any opportunity for an earlier start
  - BE Program Office: decrease planned activities to minimum required to support SEU theme, LISA, and planning for Con-X and Probes
  - BE E/PO: focus near term activities on LISA, coordinate with missions and Forum for maximum leverage
- Presentations planned by LISA, Con-X, E/PO at this meeting



# Einstein Probes

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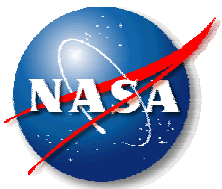
- Einstein Probe Mission Concept Studies
  - Proposals received
  - Selections announced in November 2003
  - Selected 10 proposals, spanning all probes and types
  - Funding initiated in February 2004 for 2 years each
- Expect interim report from study teams at SEU Roadmap Workshop in December 2004



# Einstein Probes

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- Dark Energy Probe (Type 1 – complete mission)
  - Jon A. Morse (Arizona State University) – The Dark Energy Space Telescope (DESTINY) Mission Concept: An Alternative to SNAP
  - Saul Perlmutter (Lawrence Berkeley National Laboratory) – Supernova / Acceleration Probe: Science
- Dark Energy Probe (Type 2 – work with DOE)
  - Edward Cheng (Conceptual Analytics, LLC) – A Novel Focal Plane and Observatory System Concept for Dark Energy Characterization Through Distant Supernova Surveys
  - Jonathan P. Gardner (NASA/GSFC) – NASA-Funded Contributions to the Supernova Acceleration Probe (SNAP) Mission
  - Saul Perlmutter (Lawrence Berkeley National Laboratory) – Probing Dark Energy with the Supernova/Acceleration Probe (SNAP): A Type 2 Proposal for a Joint DOE-NASA Mission



# Einstein Probes

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- Black Hole Finder Probe
  - Jonathan Grindlay (Harvard University) – EXIST Concept Study for Black Hole Finder Probe
  - Mark McConnell (University of New Hampshire) – A Coded Aperture Survey Telescope for Energetic Radiation from black holes (CASTER)
- Inflation Probe
  - James Bock (NASA/JPL) – Imaging Cosmic Microwave Background Polarization with EPIC
  - Gary Hinshaw (NASA/GSFC) – A Mission Concept Study for the Einstein Inflation Probe
  - Peter Timbie (University of Wisconsin-Madison) – Mission Concept Study for the Einstein Polarization Interferometer for Cosmology (EPIC)



# Next Steps: Dark Energy Probe (JDEM)

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- JDEM is the Dark Energy Probe
  - Remains a high priority for NASA and DOE
  - Both agencies require budget augmentations for JDEM
  - DOE is funding R&D for JDEM concept
  - NASA is funding mission concept studies for JDEM concepts
- NASA and DOE will appoint a Science Definition Team (SDT) for JDEM
  - Agencies will jointly select chair and members
  - “Dear Colleague” letter to both communities will be used to solicit volunteers and nominations
  - PI’s of NASA mission concept studies will be invited to serve
  - Goals: (i) Determine case for space mission, (ii) Write science requirements document for JDEM AO, (iii) Provide feedback for JDEM pre-project office, when it exists (functions as pre-SWG)
  - “Dear Colleague” letter will be issued soon (weeks) and expect first SDT meeting this Spring

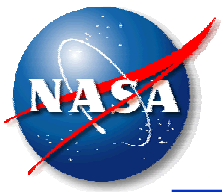




## Next Steps: Inflation Probe

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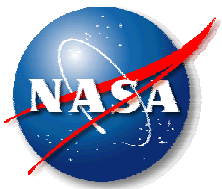
- Report of Interagency Working Group on Physics of the Universe recommends a NSF/NASA/DOE roadmap on future of CMB research
  - NSF will take lead (NSF/Nigel Sharp, NASA/Michael Salamon, DOE/Kathy Turner)
  - Ray Weiss (MIT) has agreed to chair the ~12 member Task Force on CMB Research (TFCR)
  - Schedule:
    - April 2004 – first meeting
    - Period of community input (possibly workshop)
    - Fall 2004 – another meeting
    - January 2005 – written report to agencies (supports preparation of FY07 budget)



## Next Steps – Black Hole Finder Probe

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- None identified



# Space Science Vision Missions

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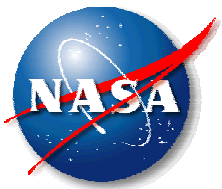
- Goals
  - Sharpen understanding of a subset of possible future missions for scientific and programmatic planning within OSS
  - Support integration of long range Agency-wide planning.
- Solicited 17 cases including
  - SEU: Big Bang Observer, Black Hole Imager, Advanced Compton Telescope, Generation-X
  - ASO: Far Infrared Telescope, Optical and Ultraviolet Telescope, Life Finder, Far Infrared and Submillimeter Interferometer
- Selected 15 proposals for 12 month studies
  - Including 3 proposals for SEU vision mission concepts
- Expect interim report from study teams at SEU Roadmap Workshop in December 2004



# Space Science Vision Missions

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- **Advanced Compton Telescope**: Witness to the Fires of Creation (Steven Boggs, UC Berkeley)
- The **Big Bang Observer**: Direct Detection of Gravitational Waves (Sterl Phinney, Caltech)
- Mission Study for **Generation-X**, a Large Area and High Resolution X-ray Observatory (Roger Brissenden, SAO)
- **Far-Infrared and Submillimeter Interferometer** (Martin Harwit, Cornell U)
- Science Promise and Conceptual Mission Design Study for **SAFIR** (Daniel Lester, U Texas)
- The Next Revolution in Astronomy: A Large **Optical-UV Space Telescope** for the 21<sup>st</sup> Century (James Green, U Colorado)



# SEUS Membership

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- Several SEUS members will rotate off SEUS this year
  - Lynn Cominsky
  - Chuck Dermer
  - Kathy Flanagan
  - Nick White
  - Hal Yorke
- Provide nominations for new SEUS members to Paul Hertz
  - Would like to get new members identified before, and invited to, July meeting
- Next meetings already set
  - July 26-27 @ San Diego
  - November 8-9 @ Washington DC



# July 2003 Report

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SEUS July 2003	
Improve the process for selecting SSUs, to be sure the process is known to the science community and to advertise widely the opportunity of SSUs to the science community.	Every project looks for opportunities; every selection letter solicits potential PRs, SSUs are emphasized at every Town Meeting.
Code S should advocate for and protect the R&A program.	Code S never proposes decreases in R&A; the community must advocate with their elected representatives.
We urge the (N)AAAC to consider a broader range of collaborative options. (b) We urge NASA to consider the breadth of observational and theoretical disciplines in making appointments.	(a) AAAC heard from DOE. (b) NASA and NSF want to concentrate on areas of overlap, not areas where there is a clear division of responsibility.
SPIDR lessons: Add scientists to review the scientific feasibility of ALL the Phase-A projects.	Agreed. Will be implemented.
(a) Keep the existing mix of Explorer classes. (b) What was the quality of proposals submitted for the 2003 SMEX AO?	(a) Agreed. (b) High. More than sufficient Category 1 proposals.
Code S pursue should information technology links with Code R with the same vigor and success they pursued links in detector technology.	On hold pending reorganization of NASA technology program.

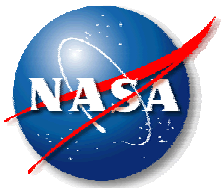


# October 2003 Report

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<b>SEUS October 2003</b>	
(a) Complete SM4, operate HST as appropriate, then de-orbit the observatory. (b) Any post-SM4 mission should be part of strategic planning.	(a) SM4 cancelled; HST will operate as appropriate, then deorbited. (b) No longer applicable.
(a) If peer review is positive, operate HETE-2 for 4-6 moths after Swift launch. (b) If peer review is positive, invite HETE-2 to Senior Review to consider a further extension.	(a) Peer review was positive, HETE-2 was extended through FY04. (b) HETE-2 has been invited to the Senior Review.
Support the best science in both the ASO and SEU themes regardless of which theme contains the R&A budget.	A&P intends to select the best proposals for funding, not limited y matching theme of proposal to theme of budget.
(a) Include the broadest possible representation on the JDEM Science Definition Team. (b) JDEM should have regular and timely releases of the data from the dark energy investigation. (c) Guest Observer program should begin in the first year. "This will greatly improve the science return of the mission."	(a) Agreed. Will be implemented soon. (b) Thank you. Goal will be to maximize the science dark energy science. (c) Lecture required.





# SEU Issues

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- Continuing program even though funding has been decreased
  - Compelling and high priority nature of science has not changed
  - Represents high priority “other science” that should be accomplished by NASA
- LISA: Coordination with ESA (management, schedule)
- Con-X: Prioritizing technology with fewer resources
- JDEM: Working on joint agency plans
- Time to Roadmap again